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THE HYPERVELOCITY EMIL PROGRAM



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Accession Number: 6331

Title: Hypervelocity EML Program

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Corporate Author Or Publisher: Strategic Defense Initiative Organization, Washington, DC 20301

Comments on Document: From BMDO/DE, Washington, DC

Abstract: The briefing included a description of the capabilities of hypervelocity guns, potential missions for HVGs, recent HVG TMD studies, D-2 projectiles, and technology support.

Descriptors, Keywords: hypervelocity gun EML electromagnetic launcher TMD D-2 projectile technology support FY92 budget dead zone high acceleration marginal cost ammunition midcourse defense

Pages: 25

Cataloged Date: Jan 06, 1998

Copyrighted or Not: NO

Document Type: HC

Number of Copies In Library: 000001

Record ID: 46034



OUTLINE

- UNIQUE CAPABILITIES OF HVG
- POTENTIAL MISSIONS FOR HVG SYSTEMS
 - NATIONAL ASSET DEFENSE
 - TMD APPLICATIONS
- RECENT HVG TMD STUDIES
 - IAT PANEL (Summer 1991)
 - POET ADVANCED TECH STUDY FOR TMD (Summer 1991)
- HVG TMD TECHNOLOGY DEVELOPMENT SCHEDULE
- D-2 PROJECTILE
- EGLIN EM GUN PROGRAM
- SDIO/TN HVG TECHNOLOGY SUPPORT
- HVG FY92 BUDGET

UNIQUE CAPABILITIES / FEATURES OF HVG

- **Very High Acceleration and Minimum Dead-Zone**
 - especially helpful for close-in defense
- **Potential for Low Marginal Cost/Round**
 - offers system cost reduction if shots/gun > x
- **Practicality of Quickly Switching "Loads"
(Different Projectiles)**
 - useful in multi-threat scenarios
- **Reduced Weight and Volume of "Ammunition"**
 - wt/vol of HVG with reloads could be << wt/vol of missile launcher with reloads if shots/gun > y
- **Potential for Very High Velocities with Very High Acceleration**
 - crucial attribute for surface-based boost phase intercept



POTENTIAL MISSIONS FOR HVG SYSTEMS



NATIONAL MISSIONS

- ASSET DEFENSE (Near Term)
- EARLY MIDCOURSE DEFENSE (Mid Term)
- GUN LAUNCH TO SPACE (Far Term)

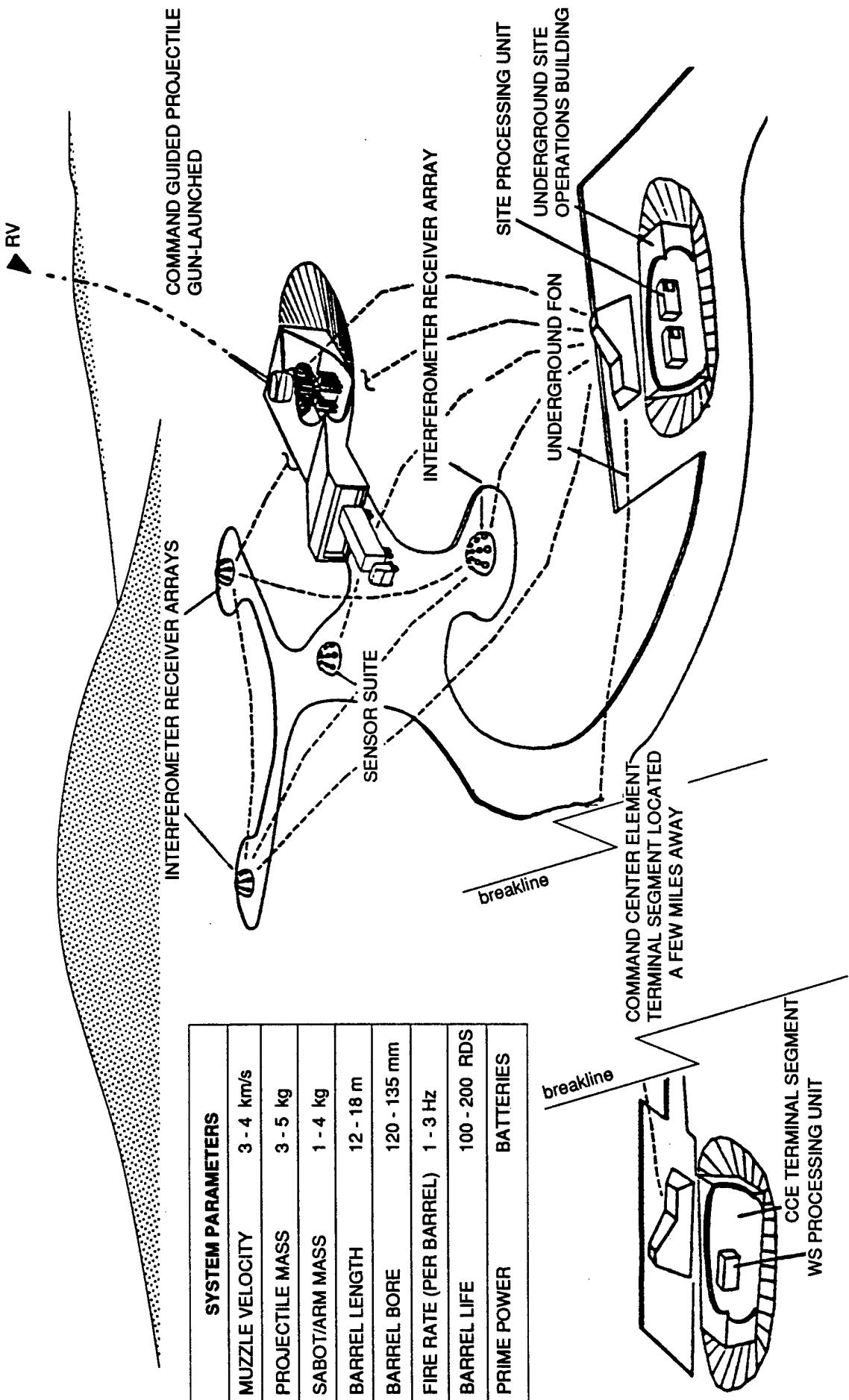
TMD MISSIONS

- THIRD TIER UNDERLAY (Near Term)
- SPECIFIED ASSET DEFENSE (Near Term)
- SUBMUNITION INTERCEPT (Near Term)
- BOOST PHASE INTERCEPT (Mid Term)

All Missions use same basic HVG Tech Base



NATIONAL MISSION CONCEPT OF OPERATION FOR HVL (ASSET DEFENSE - CONUS)





HVG APPLICATION TO TMD

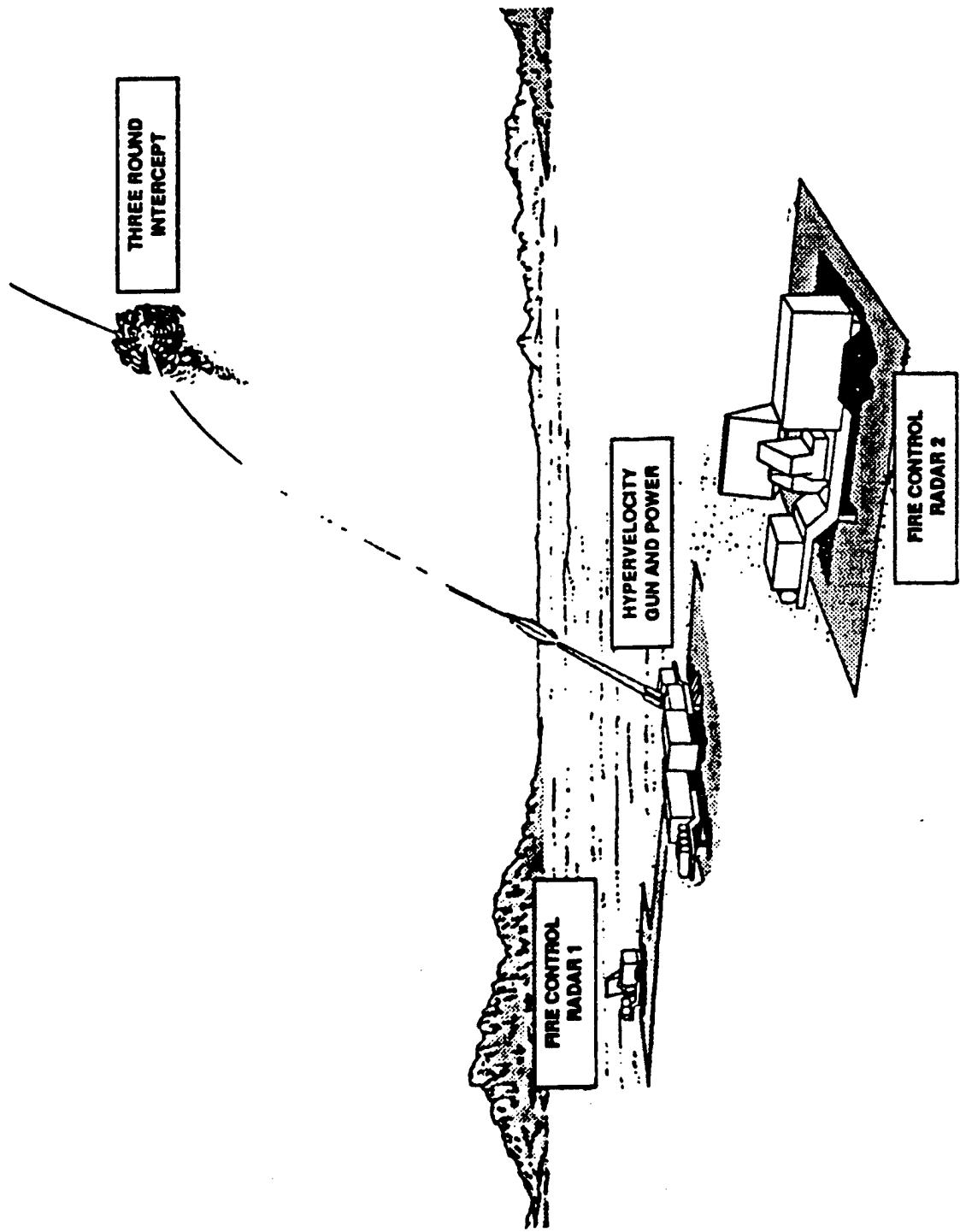
NEAR TERM

- Close-in defenses of high value targets against TBMs / ICBMs
 - exploit high acceleration, small dead zone
- Defense of high value assets against proliferated multiple threats
 - reduce cost, weight, volume of defense (cost/weight/volume per shot, switch "loads" per gun)

FAR TERM

- Intercept in boost phase from surface or air platforms
 - exploit very high velocity potential

TMD MISSION CONCEPT OF OPERATION FOR HVL (CLOSE-IN ASSET DEFENSE)



**INSTITUTE FOR ADVANCED TECHNOLOGY
PANEL STUDY**



**HYPERVERLOCITY GUN TECHNOLOGY
FOR THEATER MISSILE DEFENSE**

ANNOTATED BRIEFING

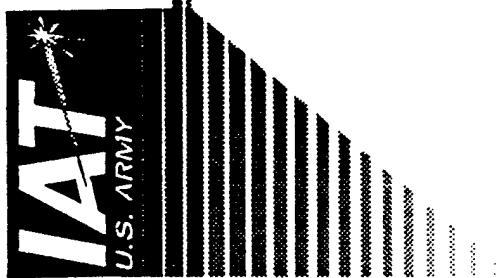
to

MG O'Neill

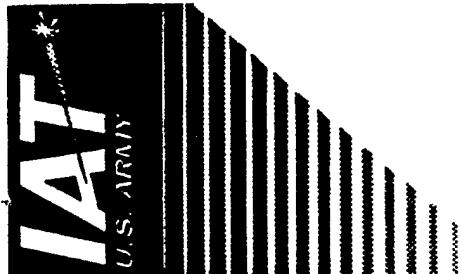
Deputy Director, SDIO

Austin, Texas

1 August 1991

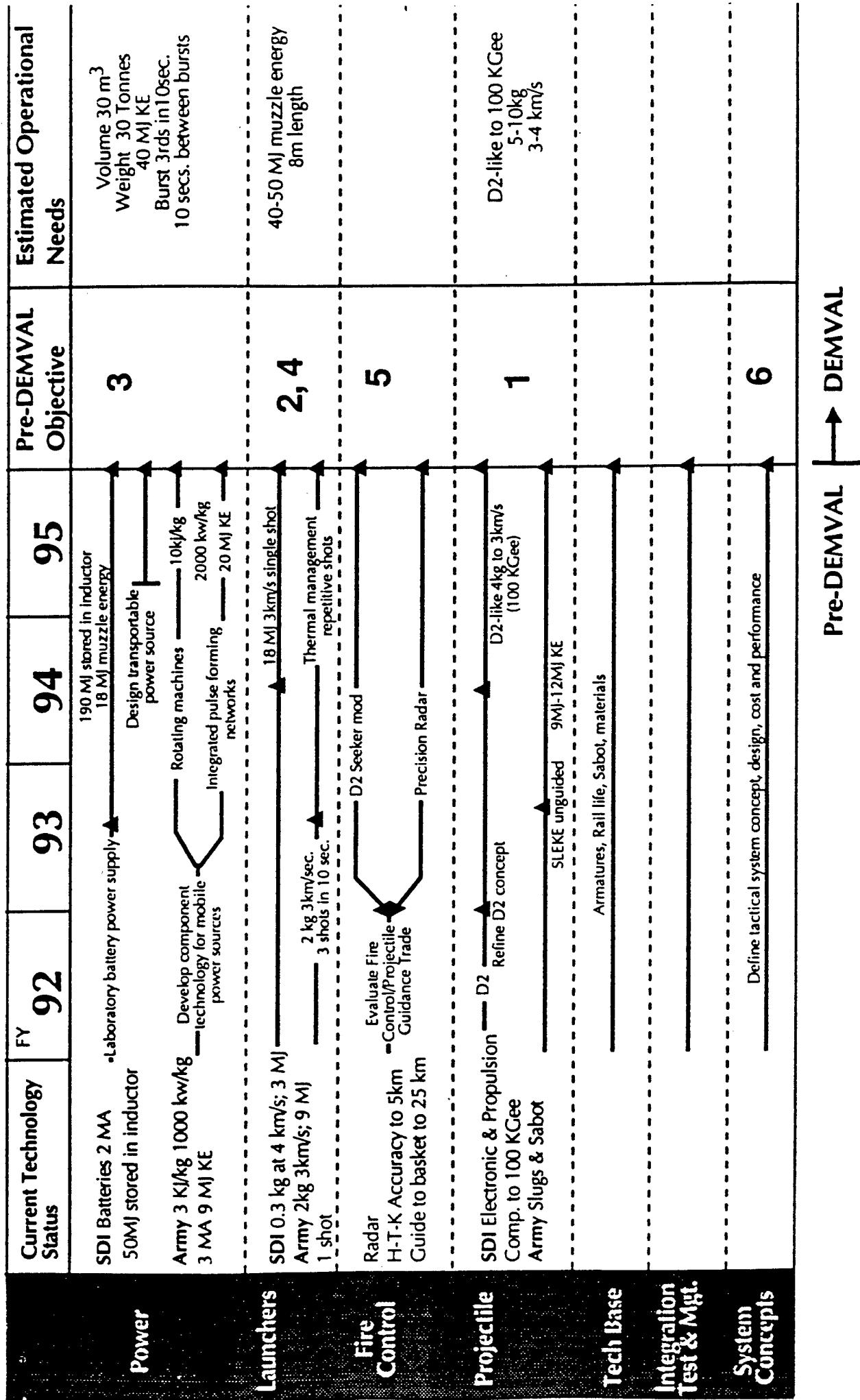


EXECUTIVE SUMMARY



- Hypervelocity guns could play a significant role in Theater Missile Defense as a terminal underplay for high confidence protection of critical assets.
- It is premature to commit today to a DEMVAL of a Hypervelocity Gun in the Theater Missile Defense role.
- A revised four-year focused technology program is recommended to mature the technologies to support a system DEMVAL decision.

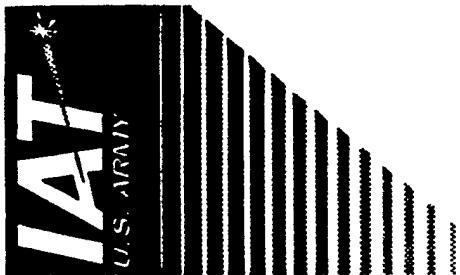
FOCUSSED TECHNOLOGY PROGRAM

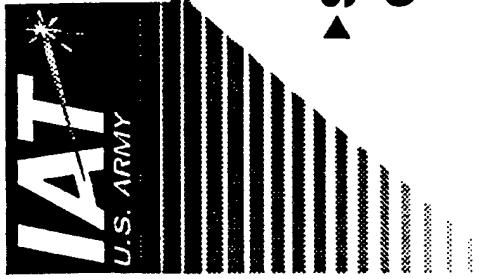


VII. FOCUSED TECHNOLOGY PROGRAM (\$M)



Current Technology Status	FY 92	93	94	95
Power	5	2	1	3
Launchers	5	3.5	2	1.5
Projectile	15	20	20	15
Fire Control	3	X	X	X
Tech Base	5	5	5	5
Integration Test & Mgt.	4	4	4	5
System Concepts	1	1	1	3
Boost Phase Tech Base	5	5	5	5
TOTAL	43	40.5+X	38+X	37.5+X





X. RECOMMENDATIONS



- SDIO focus the centrally directed HVG technology development program with stable, predictable funding.
- SDIO and Army conduct a coordinated, synchronized, mutually-dependent program:
 - SDIO continues laboratory power and 18 MJ single shot launcher facility
 - SDIO leads development of projectile and fire control
 - Army leads mobile power supply and repetitive high-efficiency launcher development
- This plan be approved, funded, and executed.

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Theater Missile Defense Advanced Technology Study

Final Review

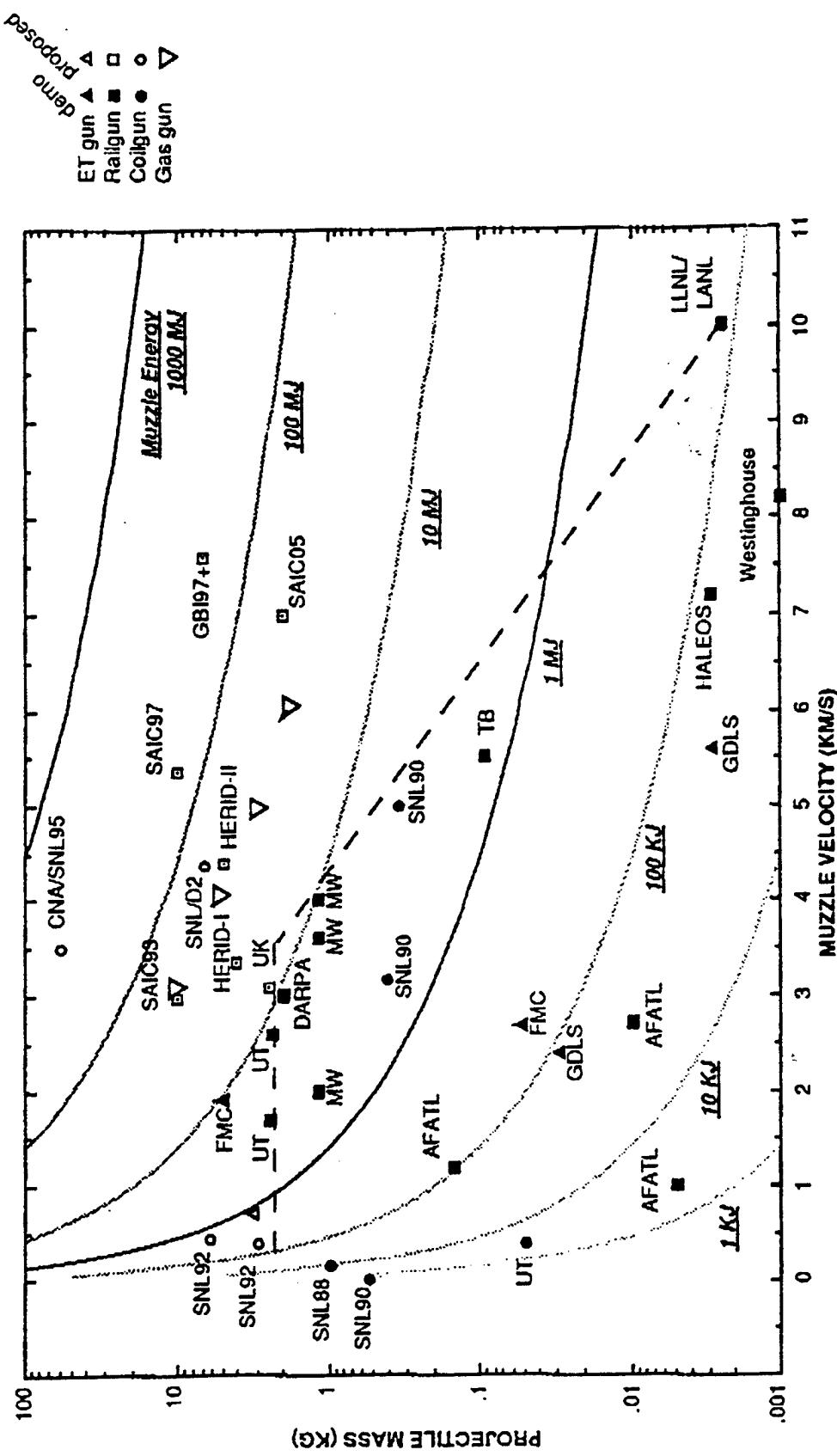
September 4, 1991

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Hypervelocity Gun Maturity Roadmap (U)

with demonstrated and proposed capabilities



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HVG&P - Findings

Ground based a promising approach if deployed at high value targets

- Use in terminal mode for defense of high value targets
- Use in midcourse mode for defense of wider area

Emphasize

- Fire control
- Deployability

Initiate TMD-only Concept Definition study

TMD Advanced Technology Availability



Technology	Near-term (~2000)	Mid-term (~2005)	Far-term (~2010)
High power laser - Airborne - Space based		Boost phase intercept	Boost phase intercept
Neutral particle beam - Space based			Midcourse discrimination
Hyper-velocity guns and guided projectiles - Ground based - Airborne - Space based			Cluster kill and high value target defense
Laser radars - Airborne - Space based		Tracking, discriminating & designating	Boost phase intercept
			BE upgrade

TMD Technology Focus

Keep Options Open

TMD Advanced Technology Review: Findings/Actions



- ABL offers greatest potential for boost phase intercept
 - Propagation and lethality major uncertainties
 - Cost, packaging, major system trades must be done

ACTION: Emphasize P&L measurements and modeling Support concept definition studies

- HVG&P good candidate for "cheap shot" cluster kill and low endo defense of high value targets
 - Fire control major uncertainty

ACTION: Focus HVG&P on cluster kill endo defense, and deployability

- Airborne LADAR can provide high quality detection and tracking to support cluster kill, fire control and discrimination

ACTION: Develop concept for implementing LADAR in TMD architecture

HVG TECHNOLOGY DEVELOPMENT SCHEDULE

(Based on FY92 Pres. Budget Funding Level of \$20M)

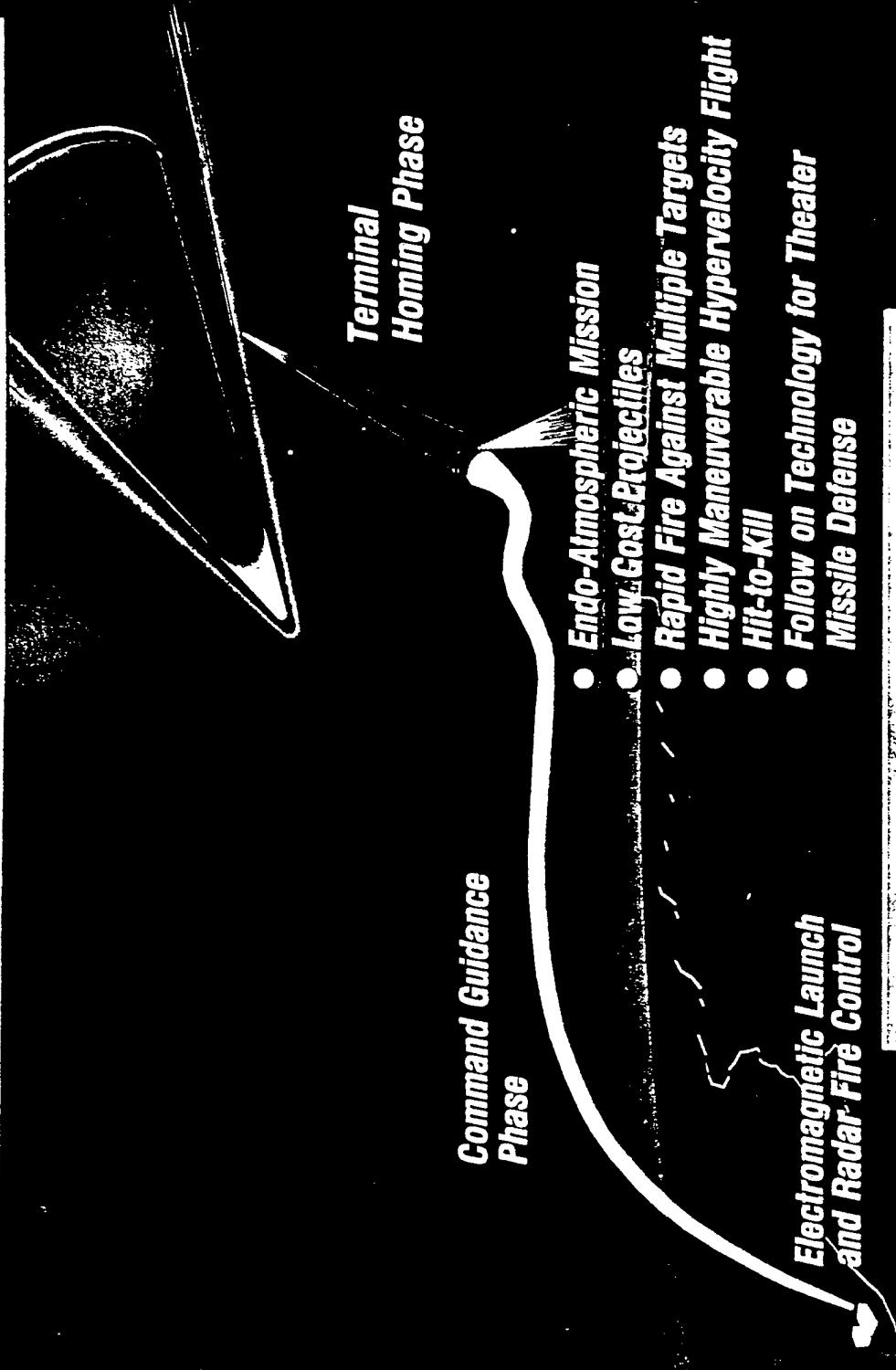
as of 18 Sep 91

PROGRAM ELEMENT	PRE-DEM VAL				DEM VAL	
	91	92	93	94	95	96
ARCHITECTURE STUDY (SE&I)						
D2 PROJECTILE	TD REQUIREMENTS CARD	TMD REQUIREMENTS CARD	SUBSYSTEM DEVEL	PROJECTILE INTEGRATION AND TEST	DEMVAL TESTING	
FIRE CONTROL				D2-VARIANT DEFINED	D2-VARIANT READY FOR MS I	
HYPERVERELOCITY LAUNCHER			PHASE II	MS I DESIGN CONCEPT	DEMVAL TESTING	
ET (SOREQ)		FC TMD REQ DEFINED	FIRE CONTROL ACCURACY KNOWN		MS I DESIGN CONCEPT	
EM (HERID)				FABRICATE 120-155 mm ETG	16 MJ SINGLE SHOT DEMVAL TESTING	
ARMY (SKID)			3 SHOTS IN 10 SEC	40 MJ TESTING		
POWER			3 SHOTS IN 10 SEC	18 MJ / 18 m BARREL TESTING	D-2 VARIANT @ 3 km/sec	
EM (HERID) LAB			3 SHOTS IN 10 SEC	PWR SUPPLY BURST RATE	SWITCHING REQ	
ARMY TMD OPERATIONAL						
TECHNOLOGY BASE				TESTING		
SYSTEM INTEGRATION & TESTING				5 MA SYSTEM TESTING	DEMVAL TESTING	
BOOST PHASE CONCEPT STUDIES AND TECH BASE				10 kJ/kg 2000 kW/kg		
TE&R						

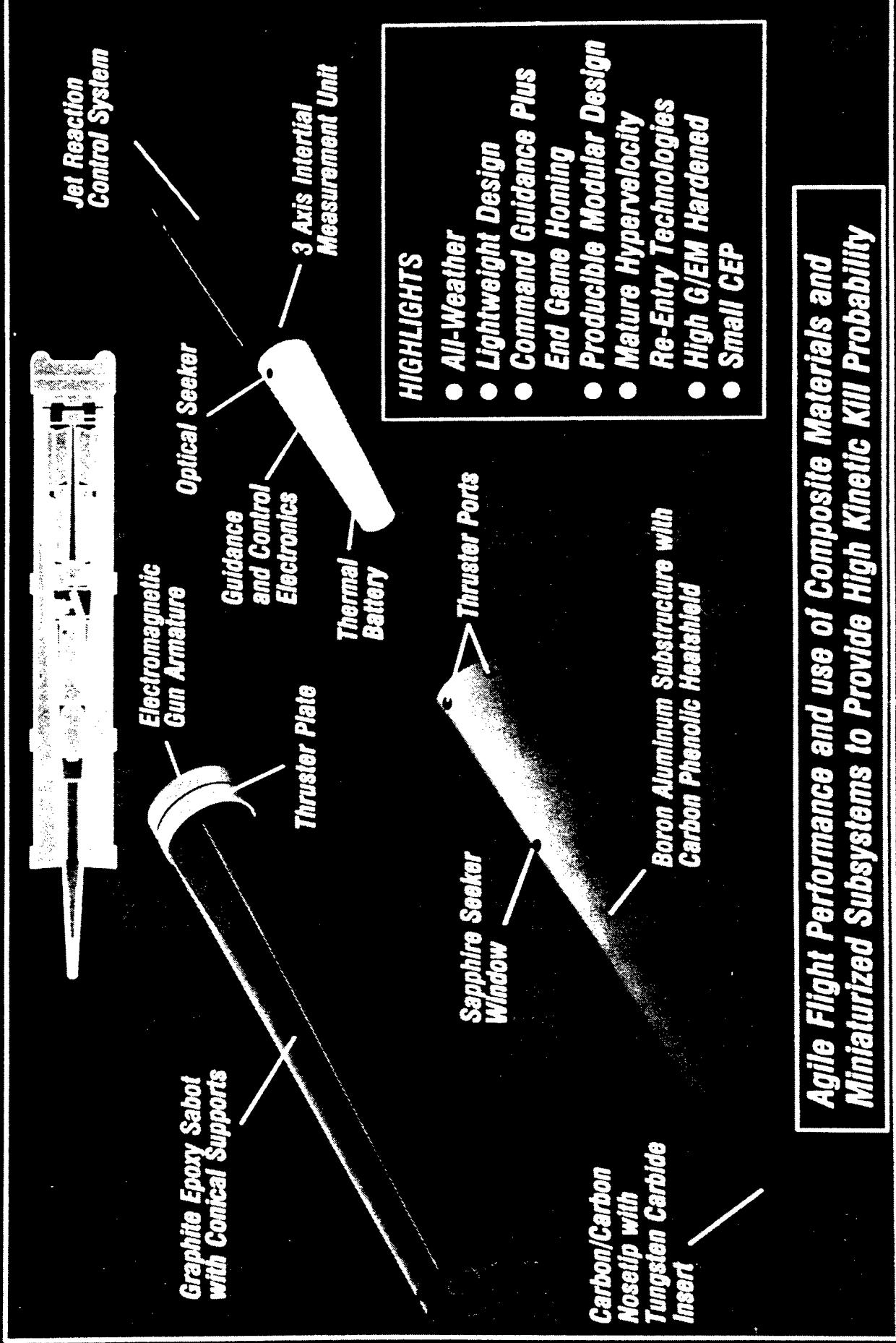




Advanced Hypervelocity Launched Guided Projectile (D2)

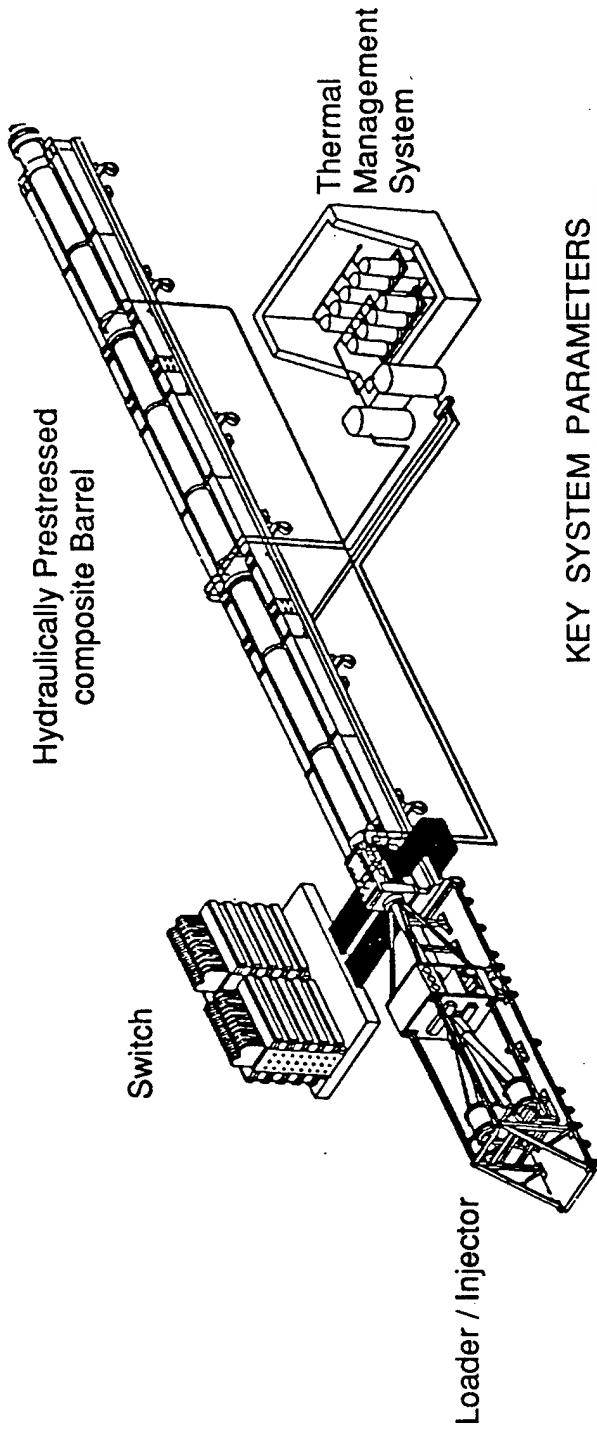


D2 Hypervelocity Guided Projectile





HIGH ENERGY RAILGUN INTEGRATION DEMONSTRATION (HERID)

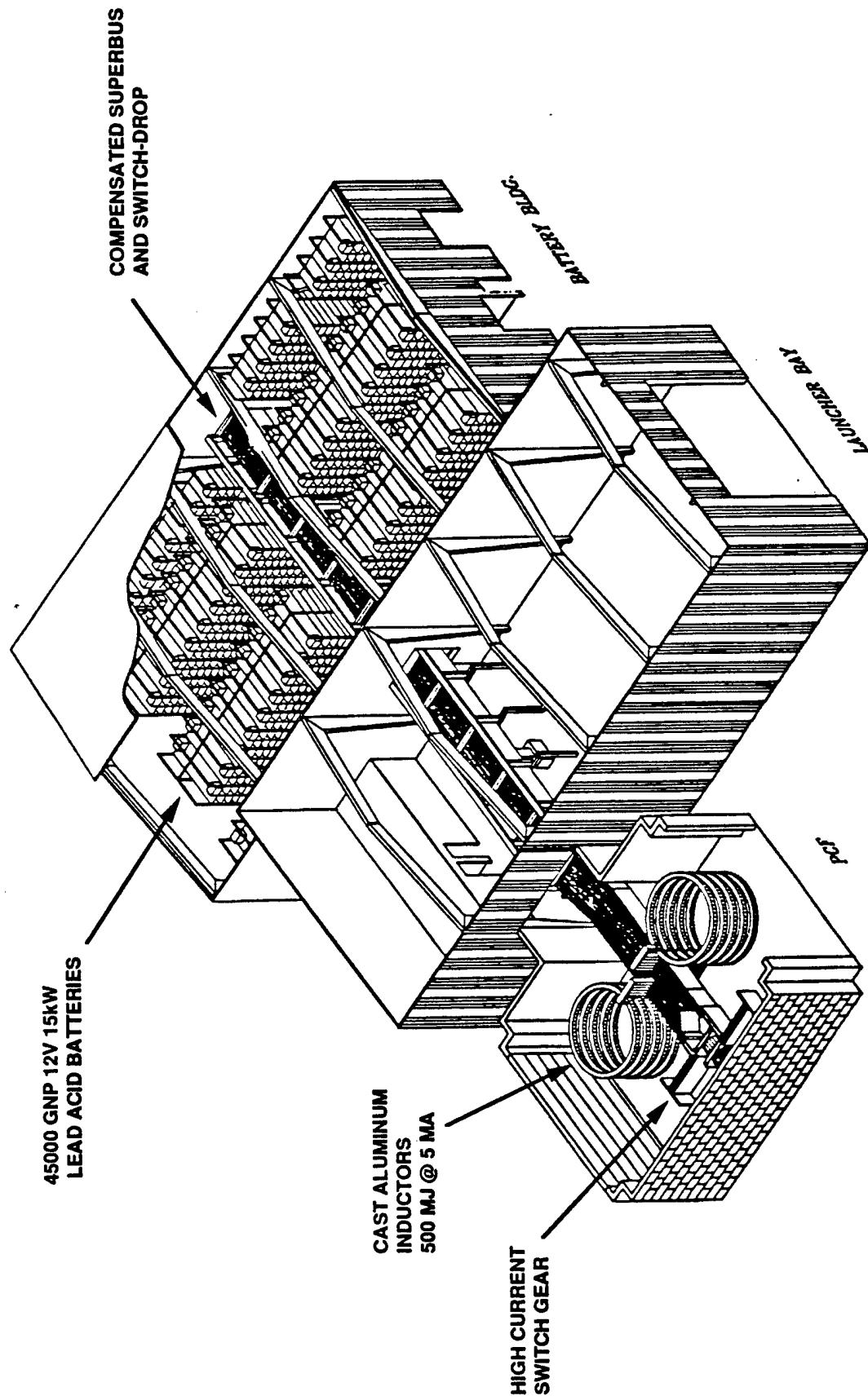


KEY SYSTEM PARAMETERS

PHASE I	
Launch Energy	> 40 MJ
Fire Rate	1 Hz
Shots per Burst	3
Peak Current	5 MA
Launch Velocity	3.6 km/s
Launch Package Mass	7 kg
Peak Acceleration	75 g
Injection Velocity	300 m/s

- PHASE I: 120 mm DIA x 18 m LONG

EGLIN PROPOSED BUS SYSTEM



RECENT EGLIN ACCOMPLISHMENTS



GUN	MASS (kg)	I (ma)	V (km/sec)	SHOTS
CHECMATE (50mmx5m)	.093	1.7	4.2	SS
CHECMATE (50mmx5m)	.135	1.3	1.8 - 2.1	2 SHOTS AT 5 HZ
HEB (90mmx10m)	2.400	1.6	1.4	SS
MARK IV (15mmx1m)	.005	0.8	1.0	30 SHOTS AT 5 HZ



PMA 1203 FY 92 BUDGET

TASK	PRES. BUDGET REQUEST (\$M)	IAT PANEL FUNDING LEVEL (\$M)
ARMY		
A1203 (1) HVG TMD CONCEPTS	0.0	FUNDED BY SDIO/TD
A1203 (2) D-2 PROJECTILE	10.0	FITS HOT FIRE YAW, SPGG FAB & TEST, 50% ELEC, BB STRUC TEST, TEST PROTO SEEKER, IMU PROCR
A1203 (3) FIRE CONTROL	0.0	FUNDED BY SDIO/TD
AIR FORCE		
F1203 (1) HV FACILITIES - 18/40 MJ batt upgrade (5 MA, 500 MJ STORED SYSTEM)	5.1	40% DEVEL COMPLETE (contract needs \$6.2M min.)
F1203 (2) TMD TESTBED BARREL - 18/40 MJ HERID gun	2.6	40% DEVEL COMPLETE (contract needs \$4.6M min.)
F1203 (3) HV EXPERIMENTS - switching - diagnostics - HV research - multi-shot	0.4	SS SWITCH DEMO DELAYED DEVELOP DIAG TECHNIQUES BASIC RESEARCH SMALL BORE TESTS
F1203 (4) ALLIED TECHNOLOGY	0.5	ARMATURE MODELING & TESTING
F1203 (5) BOOST PHASE TECH BASE INTEGRATION SUPPORT	0.0	OUTYEAR REQUIREMENT 1.4
TOTAL (\$M)	20.0	(does not meet contract requirements - BUS, D-2, HERID schedule slips) 43.0



SDIO HVG TECHNOLOGY SUPPORT

(FY92 PRES. BUDGET)

FUNDING (\$M)

TN TASKS	FUNDING (\$M)	Exercise 2a
<u>TNC (6.3)</u> • D-2 PROJECTILE • FIRE CONTROL • BATTERY UPGRADE SYSTEM • HERID LAUNCHER • TECH BASE • BOOST PHASE TECH • INTEGRATION SUPPORT	10.0 0.0 5.1 2.6 0.9 0.0 1.4	
TOTAL	20.0	0.0
<u>TNI (6.1/6.2)</u> • EMI EFFORTS (INCLUDING TBOLT) • PROJECTILE	4.0 2.3	
TOTAL	6.3	6.3
<u>TNK (6.2)</u> • HVG POWER	5.0	0.0
TOTAL		
TD TASKS	TDW	
	• HVG TMD SE&I STUDY • SOREQ GUN • HVG FIRE CONTROL • D-2 PROJECTILE (TMD VARIANT)	1.0 3.0 5.0 1.0
	TOTAL	10.0